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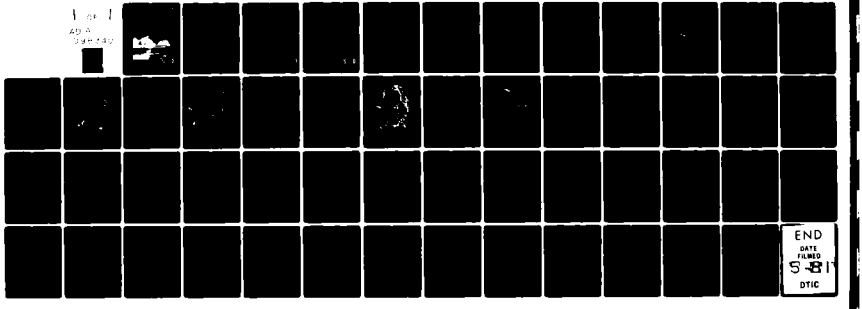

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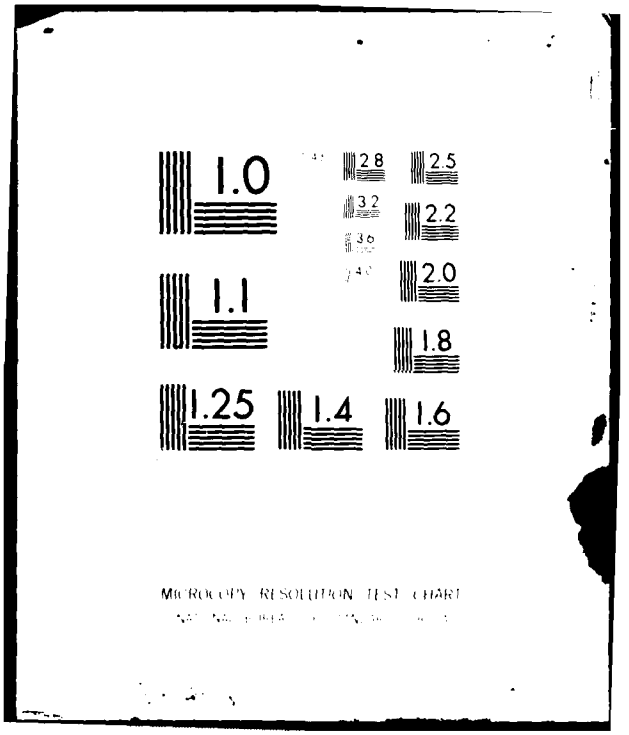
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GRAYS HARBOR AND CHEHALIS RIVER IMPROVEMENTS TO NAVIGATION ENVIRONMENTAL STUDIES

CHEHALIS RIVER FLOODPLAIN LAND COVER MAPPING BETWEEN ABERDEEN AND MONTESANO, WASHINGTON

MARCH 1980

Seattle District
U. S. Army Corps of Engineers
Seattle, Washington

Chehalis River Floodplain Land Cover Mapping Between Aberdeen and Montesano, Washington - Nelson, *et al*.

ERRATA

1. The caption for Figure 3 should read: "Land Cover map of portion of study area immediately east of that in Figure 6. (See Table 1)"

2. The caption for Figure 6 should read: "Land Cover map of western-most portion of study area. (See Table 4)"

Extensive unvegetated mudflats, as pictured on the cover, are one of the dominant habitat types in the Grays Harbor area west of the Aberdeen bridge over the Chehalis River. This habitat is less common upstream of the bridge. Photograph by John Armstrong, Environmental Resources Section, Seattle District, Corps of Engineers.

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

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ABERDEEN	HABITATS
MONTESANO	URBAN AREAS
AREAL PHOTOGRAPHY	WASHINGTON (STATE)
WILDLIFE	

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)
The habitats in the Chehalis flood plain upstream of the Aberdeen Highway Bridge to Montesano are mapped using areal photographs and ground truthing. The habitats presented are classified, discussed, and the boundaries of each are plotted on the photographs. Data are given on the total coverage of each habitat type within the study area. The species of wildlife associated with, and human usage of, the habitats are also presented.

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CHEHALIS RIVER FLOODPLAIN LAND COVER MAPPING BETWEEN ABERDEEN AND MONTESANO, WASHINGTON

(12) 34

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(10) William H. Nelson, Stephan Kalinowski, Leslie Lynam
WASHINGTON STATE DEPARTMENT OF GAME

January 1980

41 33

ABSTRACT

The habitats in the Chehalis flood plain upstream of the Aberdeen Highway Bridge to Montesano are mapped using areal photographs and ground truthing. The habitats present are classified, discussed, and the boundaries of each are plotted on the photographs. Data are given on the total coverage of each habitat type within the study area. The species of wildlife associated with, and human usage of, the habitats are also presented.

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1. Introduction. In September 1979, The Seattle District, U.S. Army, Corps of Engineers contracted the Washington State Game Department to map existing habitats in the Chehalis flood plain upstream of the Aberdeen highway bridge to Montesano (Figure 1). This report describes work performed under that contract and presents results obtained. The mapping effort precedes a broader year long environmental study sponsored by the Corps of Engineers to address impacts of the proposed widening and deepening of the navigation channel in Grays Harbor, Washington.

Sections of the Chehalis River above the Aberdeen Bridge would be dredged and material disposed of in diked areas as part of the overall widening and deepening project. Initially, 2.6 million cubic yards of material would be dredged from the channel. Depths would be maintained by annual dredging of approximately 60,000 cubic yards of material. Approximately 536 acres of diked area are proposed for dredge disposal (Figure 2).

The maps in this report are intended to aid in the evaluation of habitat losses which would be incurred in the study area if the proposed deepening and widening project is implemented. The maps delineate the general types of habitat which now exist.

2. Methods. Cover types (= habitat types) found in the study area were classified using the classification system developed by Washington Department of Game and previously published in volume III of the Snohomish Estuary Wetlands Study. The descriptions of cover types and associated wildlife values which appeared in that study were modified based on information provided by the Coastal Habitat Inventory Team, Washington Department of Game and by field work at the site.

Activities performed to determine the study area's habitat types included: identification of distinct habitat types on aerial photographs (photograph interpretation), checking designations in the field to test for accuracy (ground truthing), and finalization of designations incorporating corrections discovered during ground truthing.

During photograph interpretation, stereo pairs of black and white aerial photographs (scale 1:24,000) which had been provided by the Corps of Engineers were placed on a light table under a Leitz mirror stereoscope. A sheet of mylar was placed over one of the stereo pairs. Polygons were traced around each unit of a particular habitat type, greater than or equal to 1/2 acre in size, found in the photographs.

Ground truthing involved taking these aerial photographs and associated mylar overlays into the field to check for mapping accuracy (i.e., confirmation of habitat types and boundaries). Proposed disposal areas were inspected. Vegetation types were photographed during ground truthing and 35mm color slides have been submitted with this report.

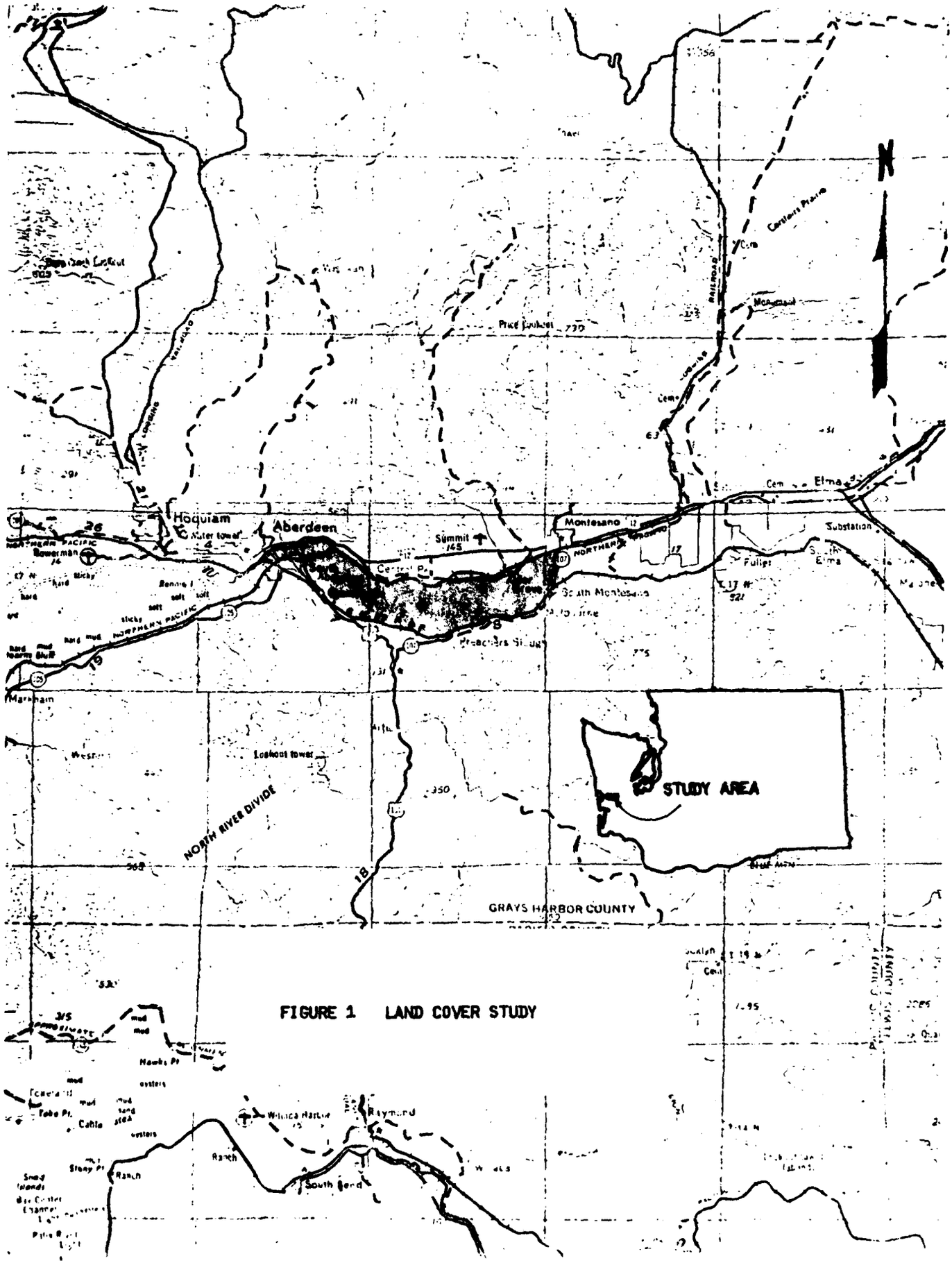


FIGURE 1 LAND COVER STUDY

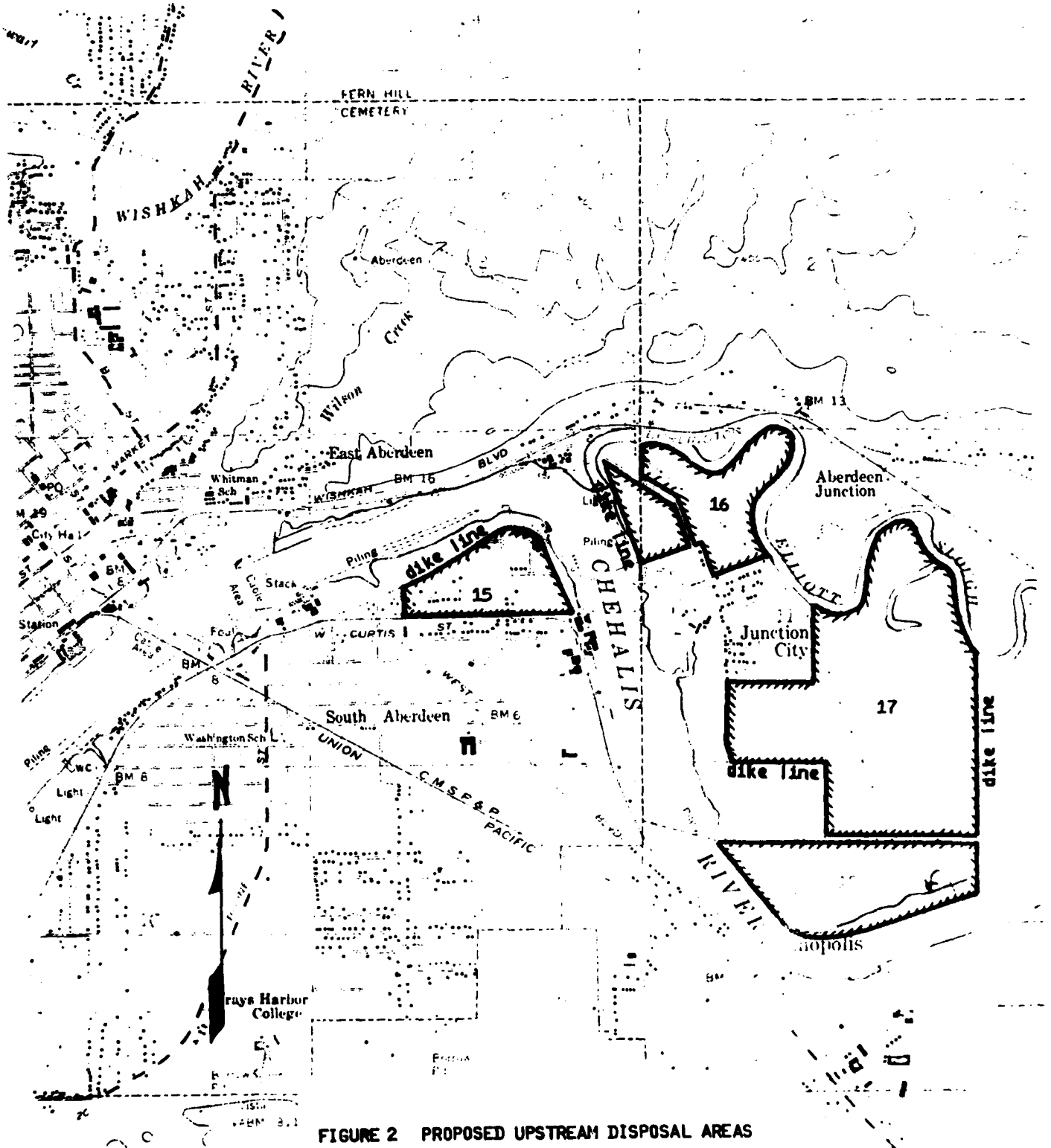


FIGURE 2 PROPOSED UPSTREAM DISPOSAL AREAS

After ground truthing, appropriate corrections were made and the overlays were finalized for printing.

Every tool has limitations of which the user should be aware, if the tool is to be used effectively. The same holds true for the maps included with this report. Some limitations include:

a. The aerial photographs used as a basis for this mapping effort were taken a few years ago (September 1976). Some changes in land use and vegetation have occurred since that time. For this reason, some of the designa- tions which appear on the photographs may not seem to coincide with the habitat type suggested by the photograph.

b. The level of detail reached in assigning designations to units of habitat is partially dependent upon the degree of detail shown in the aerial photographs and the amount of ground truthing performed as a part of the study. The classification system used in this study has four levels, one through four (see appendix A). The scope of this study effort did not allow for a highly detailed designation of some units of habitat. At the same time close examination of the classification system may provide the user with additional information on what the assigned designation may imply. For instance, units of habitat assigned the level three designation of freshwater marsh (626) may support any or all of the fourth level vegetative types listed (i.e., other, Scirpus, Typha, Scirpus-Typha, Juncus depression/pasture, or Carex).

c. Units of habitat smaller than 1/2 acre in size were usually not mapped. For example, some narrow strips of marsh vegetation probably occur along blind channels but units of habitat such as these are too small to be mapped.

d. The classification system used in this study emphasizes both land use and vegetation. As a result, some units of habitat could be given a dual designation, one stipulating vegetation and the other stipulating use. For example, the powerline which passes through the study area could be mapped as a powerline or according to the underlying vegetation. In fact, this is one case where a dual designation was made in the report. In all other cases a single designation was used. An effort was made to emphasize vegetation over land-use wherever possible, in assigning designations given the scope and depth of the study.

e. In some parts of the study area, wetlands may have been converted to agricultural use but still maintain a wetland nature. A more extensive ground truthing effort than that allowed by this study would be necessary to identify all areas where this may be the case. However, one such area was encountered during ground truthing and the agricultural designation was changed to reflect the wetland character of that unit of habitat.

3. Results. In figures 3-6 are shown the location and extent of the habitat types. Keys to the habitat numbering are given in tables 1-4. The classification system used to categorize habitat types is presented in appendix A. Brief descriptions of these habitat types and associated wildlife values are included as appendix B. Total acreages of each habitat type are shown in appendix C.

4. Discussion. The purpose of the maps prepared during this study effort is to assist in evaluation of habitat losses which would occur if the proposed deepening and widening of the navigation channel in Grays Harbor is implemented.

Wetlands are of critical importance to some wildlife. Most of the study area is adjacent to or directly influenced by streams or standing water, since the study area lies near the mouth of the Chehalis River. In this sense the major portion of the study area is wetlands. When the term "wetlands" is used below it refers to the word in this context. Federal regulations (Federal Register Volume 42, No. 138 - Tuesday July 19, 1977) define "wetlands" as follows:

> "The term 'wetlands' means those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adjusted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas."

TABLE 1

Habitat Types in Figure 3

1. Urban
   - 11 Residential
     - 111 Nonwooded Residential
     - 112 High Density Residential
   - 12 Commercial/Service/Industrial
   - 14 Transportation/Utilities
     - 143 Highway
     - 144 Railroad
     - 146 Bridge
   - 15 Harbor/Port
     - 1531 Log Storage Yard
   - 18 Open Lands
     - 183 Refuse Station
   - 19 Recreational
     - 193 Urban Wooded

3. Nonforested, Vegetated Uplands
   - 332 Riparian Grass

4. Forested Uplands
   - 43 Mixed Forest
     - 431 Regeneration Mixed
     - 434 Second Growth Mixed
   - 46 Forested Riparian
     - 4622 Immature Broadleaf
     - 4632 Immature Mixed

5. Water
   - 51 Rivers/Streams
     - 511 Estuarine
   - 57 Blind Channels
     - 571 Freshwater Blind Channel

6. Aquatic Lands
   - 61 Aquatic Land - Forested
     - 612 Freshwater Swamp
       - 6121 Shrub Swamp
       - 6121/147 Shrub Swamp/Powerline
         - 61223 Second Growth Conifer Swamp
         - 61231 Regeneration Broadleaf Swamp
         - 61232 Immature Broadleaf Swamp
         - 61233 Mature Broadleaf Swamp
         - 61241 Regeneration Mixed Swamp
         - 61242 Pole Stage Mixed Swamp
         - 61243 Second Growth Mixed Swamp
         - 61244 Mature Mixed Swamp
   - 62 Aquatic Lands - Vegetated Nonforested
     - 626 Freshwater Marsh

144
571
6121
626
61233
61244
NORTH

TABLE 2

Habitat Types in Figure 4

1. Urban
   - 11 Residential
     - 111 Nonwooded Residential
     - 112 High Density Residential
   - 12 Commercial/Service/Industrial
   - 14 Transportation
     - 143 Highway
     - 144 Railroad
       - 1482 Sewage Treatment
   - 15 Harbor/Port
     - 1531 Log Storage Yard
   - 18 Open Lands
     - 181 Scraped Areas
     - 183 Refuse Stations
   - 19 Recreational
     - 193 Urban Wooded

2. Agriculture
   - 21 Crop/Pasture

3. Nonforested, Vegetated Uplands
   - 331 Riparian Shrub

4. Forested Uplands
   - 421 Regeneration Broadleaf
   - 432 Immature Mixed
     - 4622 Riparian Immature Broadleaf
     - 4632 Riparian Immature Mixed

5. Water
   - 511 Estuarine River
   - 522 Pond
   - 571 Blind Channel

6. Aquatic Lands
   - 61 Aquatic Land - Forested
     - 6121 Freshwater Shrub Swamp
     - 6121/147 Freshwater Shrub Swamp/Powerline
       - 61222 Pole Stage Conifer Swamp
       - 61223 Second Growth Conifer Swamp
       - 61223/147 Second Growth Conifer Swamp/Powerline
       - 61231 Regeneration Broadleaf Swamp
       - 61232 Immature Broadleaf Swamp
       - 61232/147 Immature Broadleaf Swamp/Powerline
       - 61233 Mature Broadleaf Swamp

TABLE 2 (con)

Habitat Types in Figure 4

6. Aquatic Lands (con)

61241 Regeneration Mixed Swamp
61242 Pole Stage Mixed Swamp
61243 Second Growth Mixed Swamp
61243/147 Second Growth Mixed Swamp/Powerline
61244 Mature Mixed Swamp

62 Aquatic Land - Vegetated Nonforested
626 Freshwater Marsh
626/147 Freshwater Marsh/Powerline

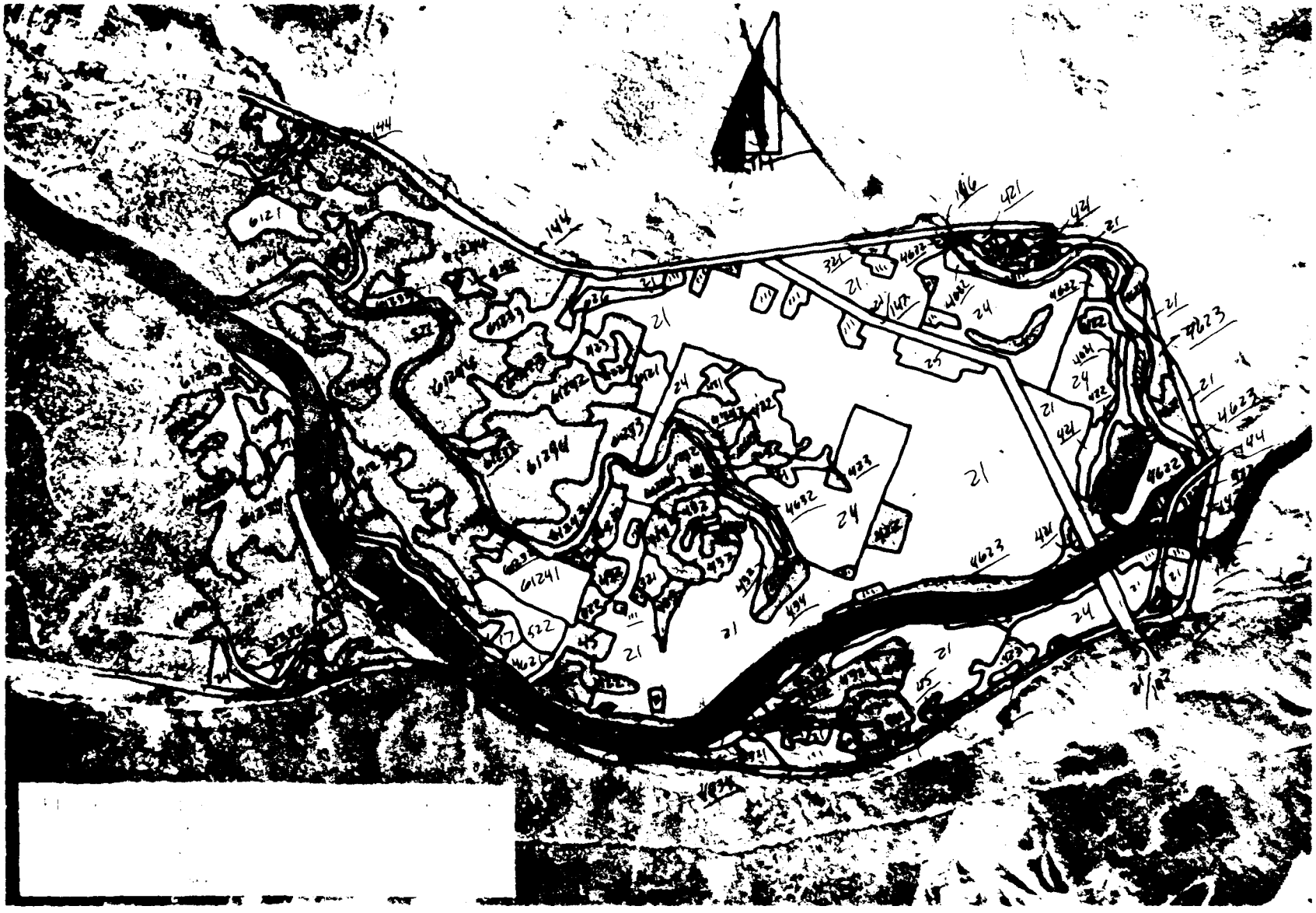


TABLE 3

Habitat Types in Figure 5

1. Urban
   - 11 Residential
     - 111 Nonwooded Residential
     - 113 Wooded Residential
   - 14 Transportation/Service/Utilities
     - 144 Railroad

2. Agriculture
   - 24 Inactive Agriculture

4. Forested Uplands
   - 423 Mature Broadleaf
   - 4622 Riparian Immature Broadleaf

5. Water
   - 511 Estuarine River
   - 571 Blind Freshwater Channel

6. Aquatic Lands
   - 61 Aquatic Land - Forested
     - 6121 Shrub Swamp
     - 61221 Regeneration Coniferous Swamp
     - 61222 Pole Stage Conifer Swamp
     - 61223 Second Growth Conifer Swamp
     - 61233 Mature Broadleaf Swamp
     - 61241 Regeneration Mixed Forest Swamp
     - 61242 Pole Stage Mixed Forest Swamp
     - 61244 Mature Mixed Forest Swamp
   - 62 Aquatic Land Vegetated - Nonforested
     - 626 Freshwater Marsh

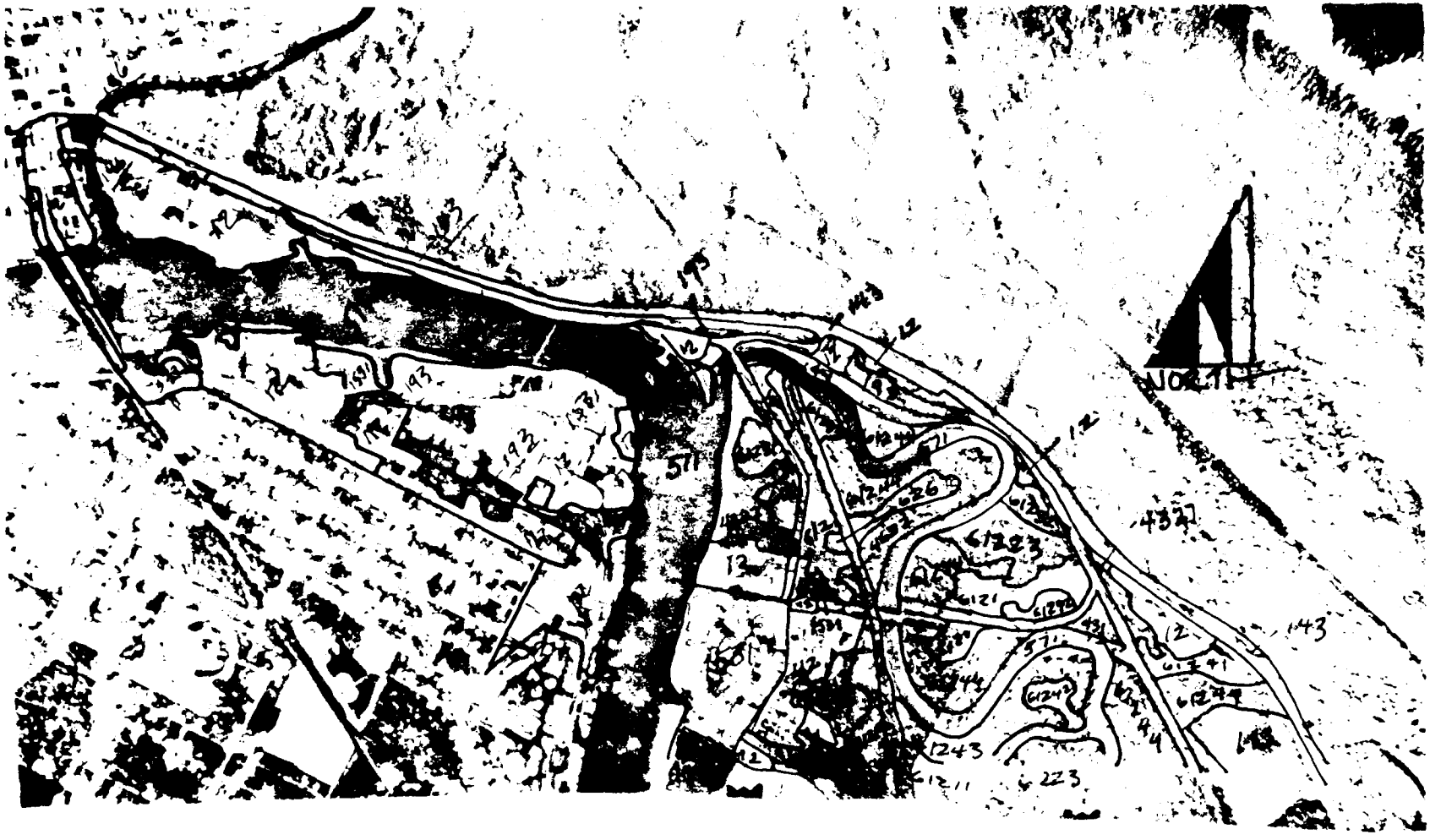

NORTH
511
1243
1211
223
143

TABLE 4

Habitat Types in Figure 6

1. Urban
   - 11 Residential
     - 111 Nonwooded Residential
   - 14 Transportation/Utilities
     - 143 Highway
     - 144 Railroad
     - 146 Bridge
   - 15 Harbor/Port
     - 152 Marina
   - 17 Extractive

2. Agriculture
   - 21 Crop/Pasture
   - 21/147 Crop/Pasture/Powerline
   - 24 Inactive Agriculture
   - 25 Farm Yard

3. Nonforested, Vegetated Uplands
   - 321 Successional Shrub
   - 331 Riparian Successional Shrub
   - 332 Riparian Grass

4. Forested Uplands
   - 413 Second Growth Conifer
   - 421 Regeneration Broadleaf
   - 422 Immature Broadleaf
   - 423 Mature Broadleaf
   - 432 Immature Mixed Forest
   - 434 Second Growth Mixed Forest
   - 45 Disturbed Forest
     - 4621 Riparian Regeneration Broadleaf
     - 4622 Riparian Immature Broadleaf
     - 4623 Riparian Mature Broadleaf
     - 4632 Riparian Immature Mixed Forest
     - 4634 Riparian Mature Mixed Forest

5. Water
   - 51 River/Stream
     - 511 Estuarine
     - 512 Pastoral
   - 56 Lagoon
     - 562 Open
   - 57 Blind Channel
     - 571 Freshwater

6. Aquatic Lands
   - 61 Aquatic Land - Forested
     - 6121 Shrub Swamp
       - 61221 Regeneration Coniferous Swamp

TABLE 4 (con)

Habitat Types in Figure 6

6. Aquatic Lands (con)

61223 Second Growth Coniferous Swamp
61232 Immature Broadleaf Swamp
61233 Mature Broadleaf Swamp
61242 Pole Stage Mixed Forest Swamp
61244 Mature Mixed Forest Swamp

62 Aquatic Lands - Vegetated Nonforested

626 Freshwater Marsh

This report does not attempt to correlate the legal definition of wetlands to the term wetland as used in this habitat classification system. A discussion of how the classification system used in the Snohomish Estuary Wetlands Study was applied to wetlands of the Chehalis River study area follows. While the Snohomish classification system can easily be applied to most land areas, each project area is unique. The wetlands of the Chehalis River are no exception.

Much similarity exists between wetlands at the mouth of the Chehalis River and the Snohomish River. Vegetation types are similar and both areas have agricultural activities. The major difference between the two areas is the extent of forested swamp. Most of the wetlands of the Snohomish River mouth are marsh or former marsh converted to agricultural or industrial use. Only a small percentage of the total wetlands are spruce swamps. In comparison, the spruce swamps found on the Chehalis River wetlands are extensive. The classification of spruce swamps contained in the Snohomish wetlands study was sufficient to describe the small portion of the total study area represented by the type, but it is not adequate to describe the extensive spruce swamps found on the Chehalis. For this reason the freshwater swamp class (612) (see page 23) was redefined as follows:

612 Freshwater Swamp
- 6121 Shrub Swamp
- 6122 Coniferous Swamp
  - 61221 Regeneration
  - 61222 Pole Stage
  - 61223 Second Growth
  - 61224 Old Growth
- 6123 Broadleaf Swamp
  - 61231 Regeneration
  - 61232 Immature
  - 61233 Mature
- 6124 Mixed Forested Swamp
  - 61241 Regeneration
  - 61242 Pole Stage
  - 61243 Second Growth
  - 61244 Mature

Descriptions of these types are included in appendix B. The forested wetlands of the Chehalis River study area are primarily dominated by Sitka spruce (Picea sitchensis), red alder (Alnus rubra), and black cottonwood (Populus trichocarpa). There is standing water at various times during the year over the entire area. As a result, there is a network of naturally formed drainage channels throughout the area. Small channels join into larger channels that are visible on the aerial photographs and mapped as blind freshwater channels (571). The forested swamp should provide excellent habitat for a number of species such as Wood Duck and Hooded Merganser.

Another wetland type found in the Chehalis River study area is freshwater marsh (626). Freshwater marshes are dominated by cattail (Typha latifolia), with sedge (Carex sp.) and rush (Juncus spp.) communities along the edge of the river. Great blue herons, red-winged blackbirds, and ducks use this habitat.

Species observed or indicated by sign during ground truthing include black-tailed deer (Odocoileus hemionus columbianus), marsh hawks, red-tailed hawks, and great blue herons.

In the classification system used in this study, agricultural lands are divided into two broad categories, active and inactive. The primary activity on cleared agricultural lands in the Chehalis River study area is grazing of cattle and horses. Other land use activities in the study area include residential and business, industrial, and gravel extraction.

We would like to acknowledge contributions by the following people in preparing this report: Karen Helmerson, Rick Albright, Ron VanBianchi, Jack Howerton, Doug Wechsler, Ron Hirschi, Sue Peterson, Michelle Brown, Debbie Patrick, David Mudd, and Harte Pentilla.

APPENDIX A

Habitat Classification System for the Chehalis Flood Plain Between the Aberdeen Highway Bridge and Montesano **

Level 1	Level 2	Level 3	Level 4	Level 5
*1 Urban	*11 Residential	*111 Nonwooded Residential		
		*112 High Density Residential		
		*113 Wooded Residential		
	*12 Commercial/ Service/Industrial			
	*14 Transportation/ Utility	141 Airport		
		142 Ferry Service		
		*143 Highway		
		*144 Railroad		
		145 Pipeline		
		*146 Bridge		
		*147 Powerline/ Rights-of-way		
		*148 Water and Waste Treatment/ Storage	1480 Other	
			1481 Water Supply	
			*1482 Sewage Treatment	
	*15 Harbor/Port	*152 Marina		
		*153 Log Storage	*1531 Log Yard	
			1532 Log Raft	
		154 Riprap		
		155 Dike		
		156 Breakwater		
		157 Piling		
		158 Pier		

*Habitat types mapped in the study area.
**Revised from the classification system published in Snohomish Estuary Wetlands Study, Classification and Mapping, volume III, 1978, Galen Burrell.

Level 1	Level 2	Level 3	Level 4	Level 5
*1 Urban (con)	16 Construction			
	*17 Extractive			
	*18 Open Land	*181 Scraped Area		
		182 Dredge/Fill		
		*183 Refuse Station		
	*19 Recreation	191 Park		
		192 Golf Course		
		*193 Urban Wooded		
*2 Agriculture	*21 Crop/Pasture			
	22 Orchard/Vine-yard/Nursery	221 Orchard		
		222 Vineyard		
		223 Nursery		
	23 Mariculture			
	*24 Inactive Agriculture			
	*25 Farm Yard			
*3 Nonfor-forested Vegetated Uplands	*31 Grassland	311 Meadow		
		312 Beach Grassland		
		313 Open Grassland		
	*32 Shrub	320 Other		
		*321 Successional Shrub		
	*33 Riparian	*331 Shrub		
		*332 Grass		
		*333 Shrub--Grass		
	34 Bluff			
*4 Forested Uplands	*41 Coniferous Forest	411 Regeneration (to 14 years)		
		412 Pole Stage (closed canopy)	4120 Other	
			4121 Pole Stage/ Successional Shrub	
		*413 Second Growth (open canopy)	4130 Other	
			4131 Douglas Fir-Madrone, Second Growth	

*Habitat types mapped in the study area.

Level 1	Level 2	Level 3	Level 4	Level 5
*4 Forested Uplands (con)		414 Old Growth (approx. 150)	4140 Other	
			4141 Douglas Fir-Madrone, Old Growth	
		415 Christmas Trees		
	*42 Broadleaf Forest	*421 Regeneration Broadleaf	4210 Other	
			4211 Regeneration Broadleaf/ Successional Shrub	
		*422 Immature Broadleaf	4220 Other	
			4221 Immature Broadleaf/ Successional Shrub	
		*423 Mature Broadleaf	4230 Other	
			4231 Mature Broadleaf/ Successional Shrub	
	*43 Mixed Forest	431 Regeneration Mixed		
		*432 Immature Mixed		
		433 Mature Broadleaf/ Old Growth Conifer		
		*434 Second Growth Mixed		
	44 Open Woodland	451 Clearcut Forest		
	*45 Disturbed Forest	452 Grazed Forest		
	*46 Forested Riparian	*461 Coniferous	4611 Regeneration	
			4612 Pole Stage	
			*4613 Second Growth	
			4614 Old Growth	
		*462 Broadleaf	4621 Regeneration	
			*4622 Immature	
			*4623 Mature	

*Habitat types mapped in the study area.

Level 1	Level 2	Level 3	Level 4	Level 5
*4 Upland Forest (con)		*463 Mixed Forest	4631 Regeneration	
			*4632 Immature	
			4633 Second Growth	
			*4634 Mature	
	47 Forested Bluff	471 Coniferous		
		472 Broadleaf		
		473 Mixed		
*5 Water	*51 River/Stream	511 Estuarine Zone		
		*512 Pastoral Zone		
		513 Floodway Zone		
		514 Boulder Zone		
		515 Intermittent Stream Zone		
	*52 Lake/Pond	521 Lake		
		*522 Inland Pond		
		523 Coastal Pond		
		524 Beaver Pond		
		525 Farm Pond		
		526 Fish Rearing Facility		
	53 Reservoir			
	54 Bay/Estuary			
	55 Impoundment			
	*56 Lagoon	561 Enclosed Lagoon		
		*562 Open Lagoon		
	*57 Blind Channel	*571 Freshwater Blind Channel		
		572 Marine Blind Channel		
	58 Canal/Waterway			
	59 Open Water			
*6 Aquatic Lands	*61 Aquatic Land-Forested	611 Intertidal Freshwater/ Brackish Swamp	6111 With Picea	
			6122 Without Picea	

*Habitat types mapped in the study area.

Level 1	Level 2	Level 3	Level 4	Level 5
*6 Aquatic Land (con)		*612 Freshwater Swamp	*6121 Shrub Swamp	*61221 Regeneration
				*61222 Pole Stage
			*6122 Coniferous Swamp	*61223 Second Growth
			*6123 Broadleaf Swamp	61224 Old Growth
			*6124 Mixed Forested Swamp	*61231 Regeneration
				*61232 Immature
				*61233 Mature
				*61241 Regeneration
				*61242 Pole Stage
				*61243 Second Growth
				*61244 Mature
	*62 Aquatic Land-Vegetated Nonforested	621 Nereocystis Communities		
		622 Other Algal Associations	6221 Ulvoid	
			6222 Laminarian	
			6223 Fucoid	
		623 Eelgrass (Zostera spp.)		
		624 Salt Marsh	6240 Other	
			6241 Carex	
			6242 Triglochin-Carex	
			6243 Carex-Pontentilla-Agrostis-Triglochin-Deschampsia	

*Habitat types mapped in the study area.

Level 1	Level 2	Level 3	Level 4	Level 5
*6 Aquatic Lands (con)			6244 Juncus-Potentilla-Agrostis-Triglochin-Deschampsia	
			6245 Disturbed Carex	
			6246 Scirpus	
			6247 Salicornia	
		625 Brackish/ Freshwater Intertidal Marsh	6250 Other	
			6251 Scirpus	
			6252 Scirpus-Typha	
			6253 Typha	
			6254 Carex	
		*626 Freshwater Marsh	6260 Other	
			6261 Scirpus	
			6262 Typha	
			6263 Scirpus-Typha	
			6264 Juncus depression/ pasture	
			6265 Carex	
	63 Aquatic Land - Nonvegetated	631 Rock		
		632 Cobble		
		633 Mixed Coarse		
		634 Mixed Medium		
		635 Mixed Fine		
		636 Sand		
		637 Sand-Silt		
		638 Silt/Clay or Mud		
7 Other Lands	71 Spit	711 Vegetated Spit		
		712 Nonvegetated Spit		
	GB Gravel Bar			
	SB Sand Bar			

APPENDIX B

Habitat Descriptions for the Chehalis Flood Plain Between the Aberbeen Highway Bridge and Montesano*

1 Urban. Developed areas are given this designation. Such areas support residential, commercial, industrial, and transportation uses. Wildlife use and degree of natural cover serve as indicators of the value of existing urban habitats relative to natural conditions.

11 Residential. Human dwellings and adjacent lands (lawns, gardens, parking area, etc.) are included in the designation. Residential development substantially degrades much of an area's value to wildlife resources by destroying natural vegetative cover and associated habitat values. Residential areas provide a limited amount of habitat to a few kinds of wildlife such as common songbirds and small mammals, e.g., house finch, house sparrows, robins, squirrels, and raccoons. Larger birds and mammals require larger territories and are the first to disappear with residential construction. In general, areas of low density housing contain a greater amount and diversity of wildlife habitat than areas of high density housing. As a result, numbers of wildlife species also increase.

111 Nonwooded Residential. This designation applies to nonwooded areas of low density housing (less than two dwellings per acre) usually occurring outside incorporated communities. Natural cover usually is drastically altered and replaced with horticultural plantings.

112 High Density Residential. Areas designated have high density housing including single and multi-family units as well as neighborhood services.

113 Wooded Residential. Well wooded areas with low density housing (less than two dwellings per acre) are included in this class. The natural cover is usually minimally altered.

12 Commercial/Service/Industrial. The designation includes areas developed for commercial, public service, and industrial purposes. Such areas are usually, but not always, heavily impacted by human structures and activities. Values to wildlife are usually extremely limited. In most cases, development has decreased or eliminated wildlife that formerly used these habitats.

14 Transportation/Utilities. Areas of suffic ent size to be mapped which are used for transportation and utility purposes and have an important impact on wildlife resources are included in this designation. Positive and negative influences on wildlife vary depending on the type of facility present.

*Taken from Snohomish Estuary Wetlands Study, Classification and Mapping, Volume III, 1978, Galen Burrell; modified based on information provided by Washington State Game Department's Coastal Habitat Inventory Team and by field inspection of the study area.

143 Highway. This designation is assigned to major thoroughfares and adjacent rights-of-way. Highways are highly detrimental to wildlife: habitat is permanently eliminated by construction, traffic and pedestrians are a constant disturbance to wildlife, many animals are killed attempting to cross highways, and highways can encourage dispersal of exotic pests such as starlings. Secondary loses of wildlife habitat which occur with developments along highways such as commercial services and housing are also important.

Value of roadside vegetation to birds and other animals can be increased by proper management such as planting shrubs which don't need mowing or spraying, or by delaying roadside mowing and spraying until July or later.

Sections of highways built along the shoreline of the Chehalis River have severely altered important edge habitat between upland and aquatic environments.

144 Railroad. Railroads and adjacent rights-of-way are included in this designation. Railroads have negative impacts on wildlife habitat similar to those associated with roads - habitat loss during construction and animal kills during crossings.

146 Bridge. Major bridges are included in this designation. Negative effects on habitat values can occur during construction, including alteration in current, velocity, and water circulation patterns. Salinity may be affected in estuarine environments. Bridges can encourage human use of undeveloped areas.

147 Powerlines and Rights-of-Way. This designation includes powerlines and associated rights-of-way. These lands are used by wildlife plreferring "edge", habitat where brush and trees occur next to open lands. Such wildlife include black-tailed deer, red-tailed hawks, and rodents. Powerline rights-of-way may act as corridors for the dispersal of exotic species, such as dogs.

148 Water and Waste Treatment/Storage. Ponds used for treatment of sewage effluent and storage of potable water are assigned this designation.

1482 Sewage Treatment. This designation includes ponds used for treatment of sewage and mill effluent.

15 Harbor/Port. This designation includes facilites located along the shoreline and/or extending beyond the shoreline, which service commercial and recreational water-oriented commerce. It also includes structures necessary for protected morrage. Port associated activities can have profound effects on marine wildlife and plants.

152 Marina. Included are moorage areas for public or private use generally consisting of multiple piers or docks and related service facilities.

153 Log Storage. This designation includes areas used for log storage occurring on uplands, along the shoreline, or in open water. Water storage is more detrimental to wildlife resources than upland storage. It can destroy invertebrates including those fed upon by shorebirds, alter vegetation, and thus negatively impact biologic production, adversely affect juvenile salmon and flatfish which may feed in the area and seriously degrade water quality.

Log rafts can be beneficial to wildlife by serving as artificial islands. As islands they may provide resting areas for several marine birds and river otter (Lutra canadensis). They may also be used by birds, such as great blue herons as feeding platforms.

1531 Log Yard. Areas on land used for log storage are designated as log yards. Filling of swamps for such use has destroyed valuable wetlands in the Chehalis study area.

17 Extractive. This designation includes areas used for mining, especially sand and gravel extraction. Extraction mining usually destroys habitat for flora and fauna inhabiting the site. It can result in excessive upland erosion and increased sedimentation of nearby waters. Moreover, recreational opportunities may be eliminated. In general, these areas have little wildlife value.

The gravel extraction site in the Chehalis wetlands is located adjacent to the river and is fairly isolated. There is a large pond associated with this operation. This operation has expanded in recent years.

18 Open Land. The open land designation applies to areas which have little vegetation due to scraping, dredging, filling, or use as refuse stations. This designation does not refer to undeveloped or park areas.

181 Scraped Area. The designation refers to areas cleared of vegetation for subsequent development.

183 Refuse Station. Areas where garbage is dumped are designated refuse stations.

19 Recreation. This designation includes parks, camps, golf courses, or small woodlots within well-developed residential areas. These areas exhibit varying degrees of habitat alteration.

193 Urban Wooded. Included in this designation are small areas of undeveloped wooded land within well-developed urban areas. Vegetation is usually undisturbed except where occasional trails occur. In general, these woodlots help to control noise and air pollution, create welcome visual diversity, and provide urban refuges for plants, animals, and man.

Wildlife may use woodlots for feeding, resting, nesting, and cover. Small urban woods and sometimes single trees can play a critical role in maintaining wildlife species not commonly found in developed areas (e.g., hawks). These woods commonly support some small mammals, a high density of bird species, and domestic dogs and cats. Series of small woodlots often occurring in urban areas can serve as a corridor for birds. Larger woodlots with diverse vegetation support more types of wildlife than smaller woodlots. In addition to small mammals and birds, these large woodlots may support large mammals such as black-tailed deer (Odocoileus hemionus) and coyote (Canis latrans). Sensitive species (eagles, bobcats, etc.) are not common in these areas.

2 Agriculture. Lands designated as agriculture are being used, or were used, for crops, pasture, orchards, vineyards, and/or nursery lands. Agricultural lands generally provide a greater amount and diversity of wildlife habitat than urban areas. Wildlife value is correspondingly higher. The degree to which agriculture benefits wildlife depends on what crops are grown and how fields are maintained. Birds commonly associated with agricultural lands are shown in table 5. In the Chehalis River study area, pasture is the most common agricultural use. Inactive agricultural areas are also present.

TABLE 5
Birds Associated With Agricultural Habitat

Canada goose (Branta canadensis)
mallard (Anas plathynchos)
gadwall (Anas strepera)
pintail (Anas acuta)
green-winged teal (Anas carolinensis)
red-tailed hawk (Buteo jamaicensis)
rough-legged hawk (Buteo lagopus)
marsh hawk (Circus cyaneus)
merlin (Falco columbarius)
California quail (Lophortyx californicus)
ring-necked pheasant (Phasianus colchicus)
killdeer (Charadrius vociferus)
common snipe (Capella gallinago)
rock dove (Columba livia)
barn owl (Tyto alba)
short-eared owl (Asio flammeus)
horned lark (Eremophilia alpestris)
violet-green swallow (Tachycineta thalassina)
tree swallow (Iridoprocne bicolor)
barn swallow (Hirundo rustica)
common crow (Corvus brachyrhynchos)
robin (Turdus migratorius)
water pipit (Anthus spinoletta)
starling (Sturnus vulgaris)
house sparrow (Passer domesticus)
western meadowlark (Sturnella neglecta)
red-winged blackbird (Agelaius phoeniceus)
brewer's blackbird (Euphagus cyanocephalus)
brown-headed cowbird (Molothrus ater)
house finch (Carpodacus mexicanus)
Savannah sparrow (Passerculus sandwichensis)
vesper sparrow (Pooecetes gramineus)
dark-eyed Junco (Junco hyemalis)
white-crowned sparrow (Zonatrichia leucophrys)
golden-crowned sparrow (Zonatrichia atricapilla)
song sparrow (Melospiza melodia)

21 Crop/Pasture. Crops and pastures are cultivated, mowed, or grazed lands, and usually occur on flat to gently rolling slopes with good moisture levels. Use may change on an annual basis due to crop rotation. Many of these areas may have been initially created by eliminating marshes and swamps. Losses of diverse marsh communities for crop and pasture lands undoubtedly results in a reduction of many wildlife species.

Crops and pastures may be the agricultural lands most extensively used by wildlife with the possible exception of inactive agricultural areas (24). Field crops and pastures provide cover, feeding, and resting, and sometimes nesting habitat for small mammals, songbirds, waterfowl, and birds of prey. Black-tailed deer (Odocoileus hemionus columbianus), elk (Cervus canadensis), coyote (Canis latrans), marsh hawks, red-tailed hawks, and swallows are some of the wildlife commonly found in this agricultural habitat. Fields and pastures which support waterfowl and other concentrations of birds also attract birds of prey which may include peregrine falcons and bald eagles.

24 Inactive Agriculture. This designation includes agricultural fields left fallow for a period of time and undergoing a process of invasion by a variety of plant species such as annual grasses and forbs. These areas often occur as strips along agricultural fields.

These agricultural areas usually are of more value to wildlife than areas which are cultivated or grazed each year because there is greater vegetative diversity and more cover. These areas and associated aging farm structures are used by such wildlife species as red-tailed hawks, marsh hawks, owls, kestrels, California quail, ring-necked pheasants, coyote (Canis latrans), long-tailed weasel (Mustela frenata), bats and mice.

25 Farm Yard. This category includes farm buildings (barns and houses), corrals and gardens.

Farm yards are important wildlife areas in that they are usually used for feeding and nesting by a small number of species. For example, barn swallows and barn owls nest in barns.

3 Nonforested Vegetated Uplands. Uplands which are not forested are assigned this designation. Included are areas dominated by grasses, shrubs, riparian vegetation, and bluffs. Areas of riparian vegetation included in this designation are not contiguous with forests. Nonforested uplands are generally less disturbed by man than urban and agricultural areas. Wildlife use and habitat more closely resemble natural conditions.

31 Grassland. Included are all open, ungrazed upland areas with grasses as their dominant vegetation. Woody species are not present. This vegetative type occurs under many environmental conditions.

32 Shrub. The shrub designation includes upland areas in which the dominant vegetation consists of woody perennials up to 20 feet in height. Shrub-dominated communities often represent a successional state in regenerating forests; that is, the communities are in a transitional stage slowly eloving from a disturbed condition towards a climax forest community. This habitat has a high productivity level. Shrub browse supports a large population of large mammals and a great diversity of other wildlife species.

Small mammals, birds, and lizards generally use the ground layer for cover, burrows, and nests. Many species may forage on herbaceous and shrub vegetation. The shrub layer is usually used as forage by small birds and usually provides browse for deer and bears. Above the shrub layer, raptors may hunt for small mammals and birds. Hawks and owls may forage in this habitat for sparrows, mice, chipmunks, and large insects.

Shrub habitats are often closely related to other habitats because of their somewhat patchy occurrence. Many wildlife species which use shrub habitat derive the benefit of the edge effect of two adjoining habitats. For example, bears browse on shrubs but prefer coniferous forest nearby for cover. Raptors may perch on forest trees and hunt over areas of grass and shrub.

321 Successional shrub. Successional shrub is a disturbed area undergoing a series of changes in plant types as it matures toward its previous climax type of vegetation. This process is referred to as plant succession.

Shrubs are part of a natural succession of plant communities which begins with herbaceous plants and climaxes with coniferous forests. The composition of the successional shrub community may well influence what future communities will or will not develop if natural succession is altered by disturbance or management. Successional shrub is a highly productive community. Later successional stages of shrub support greater species diversity of birds and small mammals than do subclimax and climax forests.

Successional shrub provides nest sites, cover, and food for many species of wildlife ranging from hummingbirds to deer and bears. Early successional shrub communities which follow clearcutting provide concentrations of food e.g., trailing blackberry (Rubus ursinus), huckleberries (Vaccinium spp.) and salmonberry (Rubus spectabilis) for berry eating rodents, birds, and bears. Seed eating rodents and birds also find support in these areas. Shrub areas are used for forage by pollen and nectar feeding butterflies, bees, wasps, and hummingbirds and for browse by deer and elk.

33 Riparian. This designation includes uplands which are adjacent to and influenced by streams or standing water. The diversity of riparian communities is a product of the transition from water to land and the vegetation associated with each medium. Riparian zones provide

significant habitat for a wide variety of terrestial and aquatic wildlife. This is primarily due to the presence of water which allows greater plant biomass, faster growth, and greater plant diversity than drier sites in the vicinity. Animals which commonly use riparian areas include elk (Cervus canadensis), nutria (Myocastor coypu), beaver (Castor canadensis), muskrat (Ondatra zibethica), river otter (Lutra canadensis), mink (Mustela vison), coyote (Canis latrans), raccoon (Procyon lotor), long-tailed weasel (Mustela frenata), opossum (Didelphis marsupialis), black-tailed deer (Odocoileus hemionus columbianus), mallards, American widgeons, green-winged teals, song sparrows, sharp-shinned hawks, and red-tailed hawks. Birds are especially numerous in riparian areas. Moreover, riparian vegetation contributes significantly to the food base of aquatic organisms which ultimately become prey of commercially and recreationally valuable species such as trout and salmon.

331 Shrub. Areas included in this designation are riparian habitats where shrubs are dominant. Shrubs commonly associated with this designation include salmonberry (Rubus spectabilis), trailing blackberry (R. ursinus), Himalayan blackberry (R. discolor), nootka rose (Rosa nutkana), red elderberry (Sambucus racemosa), vine maple (Acer circinatum), devil's club (Oplopanax harridum), swamp gooseberry (Ribes lucustre), and stink currant (Ribes bracteosum).

Riparian shrub in the Chehalis wetlands occur adjacent to water and swamps. These areas are usually flooded periodically but do not have standing water as does the shrub swamp.

332 Grass. Areas of riparian habitat where grasses, sedges, and rushes are dominant are included in this designation.

4 Forested Uplands. This designation is given to all upland areas in which tree species form a complete or partial canopy and where trees dominate grass, shrub, or exposed rock communities. Forested uplands include areas of coniferous forest, broadleaf forest, mixed forest, open woodland, disturbed forest, riparian forest, and forested bluff.

A forest ecosystem is a complex interaction of physical and biological factors which supply rich and varied wildlife habitat. It is capable of perpetuating itself. Forest cover provides nesting, feeding, and resting sites, as well as thermal cover and migratory pathways. Coastal forests support typical lowland forest animal species including elk (Cervus canadensis), black-tailed deer (Odocoileus hemionous columbianus), bobcat (Lynx rufus), as well as small birds, small mammals, reptiles, and amphibians. Coastal forests also support several species which are rare or uncommon in inland communities. Examples include bald eagles, great blue herons, and river otters (Lutra canadensis).

41 Coniferous Forest. Forested lands in which the canopy is comprised of at least 80 percent coniferous species are assigned this designation. This vegetative cover type is extremely diverse in the Pacific Northwest and contains a complexity of constituent plant communities. Species commonly encountered in the canopy of a coastal coniferous forest include Douglas fir (Pseudostuga menziesii), western hemlock (Tsuga heteropyhlla), western red cedar (Thuja plicata), and Sitka spruce (Picea sitchensis). Depending on the age of the stand, there is usually a rather definitive subcanopy, shrub layer, and ground cover associated with a coniferous forest. This is climax vegetation in the Pacific Northwest.

413 Second Growth (Open Canopy). This age class follows the pole stage and precedes old growth. It is usually characterized by an open canopy, dense subcanopy and understory.

42 Broadleaf Forest. As the name implies, this designation is assigned to areas where broadleaf deciduous species comprise 80 percent or more of the canopy. Regenerating conifers in the subcanopy are typical of the broadleaf forest. A diverse ground cover may be present. Broadleaf species typically occupy wetter sites than do conifers. Characteristic species of this vegetative type include red alder (Alnus rubra), willow (Salix spp.), and bigleaf maple (Acer macrophyllum). These are important areas for wildlife.

421 Regenerating Broadleaf. This designation is comprised of an age class consisting of deciduous tree species less than or equal to 15 feet in height.

422 Immature Broadleaf. Included is an age class consisting of deciduous tree species between 15 and 45 feet in height.

423 Mature Broadleaf. This designation covers a forest age class greater than 45 feet in height with a well-developed subcanopy and ground cover present.

43 Mixed Forest. This designation applies to areas in which both broadleaf and coniferous species are present but where neither makes up more than 80 percent of the canopy.

Mixed forest types are probably of greater value to more species of wildlife than either coniferous or broadleaf forests. Since broadleaf and conifers occur together, this increased habitat diversity is reflected by increased wildlife diversity. Animals found in either coniferous or broadleaf forests probably occur in this forest type. Some common bird species found nesting in the mixed forest community are western flycatchers, hairy woodpeckers, pileated woodpeckers, yellow warblers, solitary vireos, and western wood pewees.

432 Immature Mixed. This age class is comprised of individual trees 15 to 45 feet in height.

434 Second Growth Mixed. This designation includes canopy of second growth conifers and broadleaf species usually with a dense subcanopy, shrub layer, and ground cover.

45 Disturbed Forest. Forested areas which have been severely altered or destroyed by natural events or human activities and have not had sufficient time to regenerate are considered disturbed. This classification excludes urban wooded areas and farm woodlots.

Forests within the study area have been grazed heavily. Grazing adversely affects wildlife values of forested uplands. The presence of cattle reduces use of the habitat by deer and disturbs other species of wildlife. Grazing results in removal of the shrub layer, trampling and removal of the ground layer, and compaction of the soil.

46 Forested Riparian. Forested riparian habitats in the Chehalis wetlands are upland types which are adjacent to water and swamps. These areas are usually flooded periodically but do not have standing water as does the forested swamp. Vegetation is dominated by coniferous and broadleaf trees. Common trees are Sitka spruce (Picea sitchensis), cedar (Thuja plicata), cottonwood (Populus trichocarpa), alder (Alnus rubra), and willow (Salix spp.).

Upland vegetation and water are found in close association making this a highly diverse wildlife habitat. Animals commonly found in this type are ruffed grouse, great blue herons, sharp-shinned hawks, great horned owls, flicker common crows, Bewick's wrens, cedar waxwings, yellow-breasted chats, red-winged blackbirds, fox sparrows, song sparrows, beaver (Castor canadensis), muskrat (Ondatra zibethica), mink (Mustela vison), long-tailed weasel (Mustela frenata), black-tailed deer (Odocoileus hemionus columbianus), elk (Cervus canadensis), and small rodents.

461 Coniferous. Included in this designation are coniferous communities which occur adjacent to and are directly affected by rivers and streams.

4613 Second Growth (Open Canopy). This age class follows the pole stage and precedes old growth. It is usually characterized by an open canopy with dense subcanopy and understory.

462 Broadleaf Forest. This designation is assigned to areas where broadleaf deciduous species usually comprise 80 percent or more of the canopy. Regenerating conifers in the subcanopy are typical of the broadleaf forest. A diverse ground cover may be present. Broadleaf species typically occupy wetter sites than do conifers. Characteristic

species of this vegetative type include red alder (Alnus rubra), willow Salix spp.), and maple (Acer spp.). These are important areas for wildlife.

4622 Immature Broadleaf. Included is an age class consisting of deciduous tree species between 15 and 45 feet in height.

4623 Mature Broadleaf. This designation covers a forest age class greater than 45 feet in height with a well-developed subcanopy and ground cover present.

463 Mixed Forest. Areas adjacent to and directly affected by rivers and streams where broadleaf and coniferous species are present but where neither makes up more than 80 percent of the canopy are included in this designation.

4632 Immature Mixed. This designation covers an age class comprised of individual trees 15 to 45 feet in height.

4634 Second Growth Mixed. This designation is assigned to a canopy of second growth conifers and broadleaf species, usually with a dense subcanopy, shrub layer, and ground cover.

5 Water. Both marine and freshwater habitats are considered. Water areas include river/stream, lake/pond, reservoir, bay estuary, lagoon, blind channel, canal/waterway, and open water communities.

51 River/Stream. Running water habitats are characterized by a definite current which varies greatly with valley shape and other geohydraulic features in different streams and in different segments of the same stream course. Wolf Bauer's geohydraulic classification system identifies four general river zones - estuarine, pastoral, floodway, and boulder. Segments of the Chehalis River included in the study fall within the pastoral zone.

The Chehalis River is the largest drainage flowing into Grays Harbor estuary and it is the chief source of fresh water. It allows movement of nutrients from upper segments of the basin into the estuary. Coastal rivers are important habitat for many wildlife including benthic invertebrates, anadromous fishes, ospreys, great blue herons, double-crested cormorants, belted kingfishers, waterfowl, grebes, gulls, river otter (Lutra canadensis), mink (Mustela vison), beaver (Castor canadensis), muskrat (Ondatra zobethica), and raccoon (Procyon lotor). Table 6 lists birds commonly associated with river habitats. Decline in water quality and alteration to rivers and streams may result in decreased productivity and numbers of animals species.

512 Pastoral Zone. This designation includes sections of the river with a sinuous channel pattern meandering through broad valleys with gently sloping walls. Sand and silt are deposited in the stream bed along the channel which slopes approximately 5 feet per mile. Oxbow lakes, which represent river channels cut off from the mainstream course, are typical in this zone.

TABLE 6
Birds Commonly Associated With River and Coastal Blind Channel Habitat

western grebe (Aechmophorus occidentalis)
pied-billed grebe (Podilymbus podiceps)
great blue heron (Ardea herodias)
green heron (Butorides virescens)
mallard (Anas platyrhynchos)
green-winged teal (Anas carolinensis)
ring-necked duck (Aythya collaris)
common goldeneye (Bucephala clangula)
bufflehead (Bucephala albeola)
common merganser (Mergus merganser)
hooded merganser (Lophodytes cucullatus)
bald eagle (Haliaeetus leucocephalus)
osprey (Pandion haliaetus)
spotted sandpiper (Actitis macularia)
solitary sandpiper (Tringa solitaria)
belted kingfisher (Megaceryle alcyon)
tree swallow (Iridoprocne bicolor)
rough-winged swallow (Stelgidopteryx ruficollis)
barn swallow (Hirundo rustica)

52 Lake/Pond. Permanent standing water habitats are numerous in the recently glaciated Pacific Northwest. They occur in local depressions of varying depth and may or may not contain emergent vegetation. They are important habitats for waterfowl, shorebirds, aquatic mammals, amphibians, fish, and, in general, species which are associated with marshes, swamps, and riparian vegetation.

522 Inland Pond. Standing water habitats with a surface area of less than 20 acres situated at higher elevations than the beach fringe or river delta are included in this class. Ponds are typically shallow; therefore, the near shore zone is an important primary producing area.

56 Lagoon. Highly protected brackish or freshwater embayments formed when bars partially or completely close the opening to shallow bays are covered by this designation.

562 Open Lagoon. This designation includes partially enclosed lagoons formed when freshwater inflow maintains a stream channel through bars formed by longshore deposition.

57 Blind Channel. Blind channels along streams and narrow marine inlets are included in this classification. They often result from abandoned stream channels which, unlike oxbow lakes and coastal ponds, have not been isolated from adjacent water masses.

Freshwater and marine channels are an important part of the estuarine system, since they allow the movement of tidal waters and, thus, nutrients into and out of the marshes. They are also important feeding and resting areas for wildlife such as waterfowl, aquatic mammals, great blue herons, and anadromous fishes.

In the Chehalis River study area, and extensive network of naturally formed freshwater channels exists.

571 Freshwater Blind Channel (Sloughs). Inlets along streams which receive backup water from the major channel are designated as freshwater blind channels or sloughs. They are similar to standing water habitats, but maintain a more open connection with the parent streams. Freshwater vegetation is typically associated with the upland margins. Vegetation of freshwater sloughs is similar to that occurring along ponds and creeks. Marginal plant species include willows (Salix spp.), red alder (Alnus rubra), black cottonwood (Populus trichocarpa), red-osier dogwood (Cornus stolonifera), and currants (Ribes divaricatum, R. bracteosum). Emergent vegetation occurring in freshwater sloughs includes cattails (Typha latifolia), slough sedge (Carex donupta) and small-fruited bulrush (Scirpus mircocarpus). Narrow strips of marsh vegetation probably occur along blind channels in the Chehalis River study area but such units of habitat are too small to be mapped.

Sloughs offer a quiet water refuge for stream animals and furbearers and, therefore, are frequented by wildlife species preferring still waters. They offer an advantage over ponds to some wildlife species because of the open connection with moving streams. Fish, such as coho salmon, which use sloughs for feeding, use nearby streams for spawning and as refuges when young.

Sloughs contribute to the productivity of an area by diversifying available habitat and providing stable systems for plants and animals to inhabit. Sloughs have a high shoreline to volume ratio and thus are greatly affected by detritus and nutrients derived from terrestial systems. Freshwater sloughs are especially important in the production of salmon, waterfowl and furbearers. Birds commonly found in this habitat are listed in table 2.

6 Aquatic Lands. This designation includes lands which are either covered by water or strongly influenced by adjacent waters. Areas included are aquatic land/forested, aquatic land/vegetated, and aquatic land/nonvegetated.

Barring urban and agricultural habitats, the Chehalis River study area is predominately forested swamp.

61 Aquatic Land - Forested. Areas included in this designation have surface or standing water during some portion of the year and are at least partially forested. Inhabitants of swamps include pileated woodpeckers, wood ducks, ruffed grouse, bald eagles, black bear (Euarctos americanus), and black-tailed deer (Odocoileus hemionus columbianus). Forested aquatic lands are generally divided according to salinity into either intertidal brackish swamp or freshwater swamp. Only freshwater swamp is present in the Chehalis River study area.

612 Freshwater Swamp. Freshwater swamps occur in valley bottoms, along river drainages, and in other low-lying coastal areas. They usually have some open water, at least seasonally, relatively dense vegetation, and level terrain. There are two major types; tree dominated and shrub dominated. Tree dominated swamps include coniferous, broadleaf, and mixed forest. The presence of woody vegetation in swamps is a primary factor which helps differentiate them from a marsh.

Swamps in which trees, marsh, and open water areas are interspersed provide habitat for a diverse group of wetland birds, mammals, and amphibians, as well as terrestrial species. Characteristic species include wood ducks, hooded mergansers, great blue herons, pileated woodpeckers, tree swallows, chickadees, common flickers, and downy woodpeckers. Hawks and owls, coyotes (Canis latrans), bobcat (Lynx rufus), and river otter (Lutra canadensis) are examples of predatory birds and mammals which may be present. The occurrence of larger carnivores is especially dependent on the size of the swamp and the presence of suitable adjacent habitats.

6121 Shrub Swamp. Shrub dominated areas which usually have some open water at least seasonally are included in this designation. Hardhack (Spiraea douglasii), willows (Salix spp.) and crabapples (Pyrus fusca) are common shrubs. Birds commonly found in shrub swamp habitats are listed in table 7.

6122 Coniferous Swamp. Freshwater swamps in which the forest canopy is comprised of at least 80 percent coniferous species are assigned this designation. Birds commonly found in forested swamp habitats are listed in table 8.

61221 Regeneration. Coniferous swamps are included which are in early stages of regeneration; individual trees may be up to fourteen years of age. Introduced herbaceous species are often interspersed with the conifer saplings because of the open canopy.

61222 Pole Stage. This class follows the regeneration stage and precedes the second growth stage. It is characterized by a closed canopy and slender, even-aged stands. The tree age and size may vary between sites.

61223 Second Growth. This age class follows the pole stage and precedes the old growth stage. It is usually characterized by an open canopy, dense subcanopy, and understory.

6123 Broadleaf Swamp. This designation includes freshwater swamps in which the forested canopy is comprised primarily of broadleaf deciduous species. Such species usually comprise 80 percent or more of the canopy. The subcanopy typically includes regenerating conifers and ground cover may be diverse. Birds commonly found in forested swamps are listed in table 8.

61231 Regeneration. This designation includes an age class consisting of deciduous tree species less than or equal to 15 feet in height.

61232 Immature. An age class consisting of deciduous tree species between 15 and 45 feet in height is covered by this designation.

61233 Mature. An age class comprised of deciduous tree species greater than 45 feet in height is included in this designation. A well-developed subcanopy and ground cover are present.

6124 Mixed Forested Swamp. Freshwater swamps in which broadleaf and coniferous species are present but where neither makes up more than 80 percent of the canopy are designated as mixed forest swamps. Birds commonly found in forested swamp habitats are listed in table 8.

61242 Pole Stage. This designation refers to the stage in forest development which follows regeneration and precedes the second growth stage. It is characterized by a closed canopy and slender even age stands. Tree age and size may vary between sites.

TABLE 7

Birds Commonly Associated With Freshwater Shrub Swamp or Marsh Habitats

pied-billed grebe (Podilymbus podiceps)
great blue heron (Ardea herodias)
green heron (Butorides virescens)
green-winged teal (Anas carolinensis)
wood duck (Aix sponsa)
ring-necked duck (Aythya collaris)
hooded merganser (Lophodytes cucullatus)
sharp-shinned hawk (Accipiter striatus)
Cooper's hawk (Accipiter cooperii)
Virginia rail (Rallus limicola)
sora (Porzana carolina)
rufous hummingbird (Selasphorus rufus)
downy woodpecker (Dendrocopos pubescens)
willow flycatcher (Empidonax traillii)
tree swallow (Iridoprocne bicolor)
rough-winged swallow (Stelgidopteryx ruficollis)
barn swallow (Hirundo rustica)
Steller's jay (Cyanocitta stelleri)
common crow (Corvus brachyrhynchos)
black-capped chickadee (Parus atricapillus)
common bushtit (Psaltriparus minimus)
Bewick's wren (Thryomanes bewickii)
long-billed marsh wren (Telmatodytes palustris)
robin (Turdus migratorius)
Swainson's thrush (Hylocichla ustulatus)
ruby-crowned kinglet (Regulus calendula)
cedar waxwing (Bombycilla cedrorum)
Hutton's vireo (Vireo huttoni)
warbling vireo (Vireo gilvus)
yellow warbler (Dendroica petechia)
yellow-rumped warbler (Dendroica coronata)
MacGillivray's warbler (Oporornis tolmiei)
yellowthroat (Geothylpis trichas)
red-winged blackbird (Agelaius phoeniceus)
brown-headed cowbird (Molothrus ater)
black-headed grosbeak (Pheucticus melanocephalus)
Lincoln's sparrow (Melospiza lincolnii)
song sparrow (Melospiza melodia)

TABLE 8
Birds Commonly Associated With Coastal Forested Swamp Habitats

great blue heron (Ardea herodias)
green heron (Butorides virescens)
mallard (Anas platyrhynchos)
wood duck (Aix sponsa)
hooded merganser (Lophodytes cucullatus)
sharp-shined hawk (Accipiter striatus)
Cooper's hawk (Accipiter cooperii)
red-tailed hawk (Buteo jamaicensis)
bald eagle (Haliaeetus leucocephalus)
osprey (Pandion haliaetus)
ruffed grouse (Bonasa umbellus)
screech owl (Otus asio)
great horned owl (Bubo virginianus)
Vaux's swift (Chaetura vauxi)
rufous hummingbird (Selasphorus rufus)
common flicker (Colaptes cafer)
pileated woodpecker (Dryocopus pileatus)
hairy woodpecker (Dendrocopos villosus)
willow flycatcher (Empidonax traillii)
Hammond's flycatcher (Empidonax hammondii)
western flycatcher (Empidonax difficilis)
olive-sided flycatcher (Nuttallornis borealis)
tree swallow (Iridoprocne bicolor)
rough-winged swallow (Stelgidopteryx ruficollis)
gray jay (Perisoreus canadensis)
Steller's jay (Cyanocitta stelleri)
common raven (Corvus corax)
black-capped chickadee (Parus atricapillus)
chestnut-backed chickadee (Parus rufescens)
red crossbill (Loxia curvirostra)
dark-eyed junco (Junco hyemalis)
fox sparrow (Passerella iliaca)
song sparrow (Melospiza melodia)
red-breasted nuthatch (Sitta canadensis)
brown creeper (Certhia familiaris)
winter wren (Troglodytes troglodytes)
Bewick's wren (Thryomanes bewickii)
robin (Turdus migratorius)
varied thrush (Ixoreus naevius)
hermit thrush (Hylocichla guttatus)
Swainson's thrush (Hylocichla ustulatus)
golden-crowned kinglet (Regulus satrapa)
cedar waxwing (Bombycilla cedrorum)
Hutton's vireo (Vireo huttoni)
warbling vireo (Vireo gilvus)
yellow warbler (Dendroica petechia)
yellow-rumped warbler (Dendroica coronata)
black-throated gray warbler (Dendroica nigrescens)
Townsend's warbler (Dendroica townsendi)
Wilson's warbler (Wilsonia pusilla)
red-winged blackbird (Agelaius phoeniceus)
brown-headed cowbird (Molothrus ater)
western tanager (Pirango ludoviciana)
black-headed grosbeak (Pheucticus melanocephalus)
evening grosbeak (Hesperiphoni vespertina)
purple finch (Carpodacus purpureus)
pine siskin (Spinus pinus)

61243 Second Growth. This designation is characterized by a canopy of second growth conifers and broadleaf species usually with a dense subcanopy, shrub layer, and ground cover.

61244 Mature. This designation includes an age class with trees greater than 45 feet in height. Subcanopy and ground cover are well-developed. Some old growth (trees over 150 years old) may be present.

62 Aquatic Land - Vegetated Nonforested. This designation includes wetlands which are nonforested but may be densely vegetated (e.g., marshes, bogs, meadows, and intertidal areas). The Chehalis River study are is located upstream from the estuary, where vegetated nonforested aquatic lands are composed entirely of freshwater marshes. Like marine plant communities, freshwater marshes are naturally fertile systems. The are used by a large number of wildlife species including beaver (Castor canadensis), muskrat (Ondatra zibethica), river otter (Lutra canadensis), coyote (Canis latrans), raptors, waterfowl, songbirds, great blue herons, fish, benthic invertebrates, and amphibians. Some of these species live almost exclusively in marshes, while others are dependent on marshes to varying degrees.

One of the most valuable functions of marshes is their ability to moderate extreme highs and lows in streamflow.

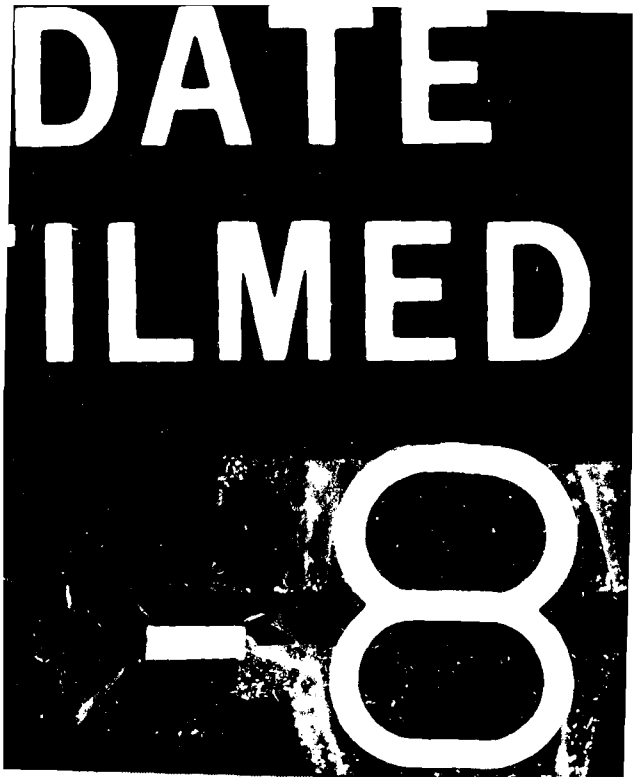
626 Freshwater Marsh. Low areas or depressions which are not under marine influence and contain standing water for all or part of the year are designated freshwater marsh. Herbaceous vegetation is dominant. Common types include sedges (Carex sp.), grasses, rushes (Juncus spp.), cattails (Typha latifolia), reed canary grass (Phalaris arundinacea), bulrushes (Scirpus spp.), skunk cabbage (Lysichitum americanum), and purple cinquefoil (Potentilla palustris). Birds which may be found in freshwater marshes are listed in table 7.

APPENDIX C

Areal Coverage of Habitats in the Chehalis Flood Plain
Between the Aberdeen Highway Bridge and Montesano

TYPE	ACRES	TYPE	ACRES
111	79.7	434	38.8
112	17.7	45	22.2
113	2.8	4621	35.4
12	222.9	4622	96.2
143	77.9	4623	20.2
144	259.2	4631	5.6
146	7.2	4632	39.9
147	93.6	4634	27.4
1482	19.5	512	**
152	*	522	25.0
1531	282.7	562	25.0
17	8.3	571	647.8
181	13.9	6121	1,202.2
183	24.4	61221	66.7
193	22.3	61222	202.9
21	611.9	61223	966.9
24	225.2	61231	29.6
25	13.9	61232	163.8
321	38.4	61233	368.0
331	27.8	61241	60.6
332	9.7	61242	284.4
413	25.0	61243	143.7
421	27.8	61244	1,329.4
422	80.6	626	243.7
423	50.0		
432	77.8		

* Less than 2 acres.
** Chehalis River; acres not determined.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